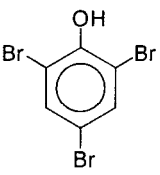
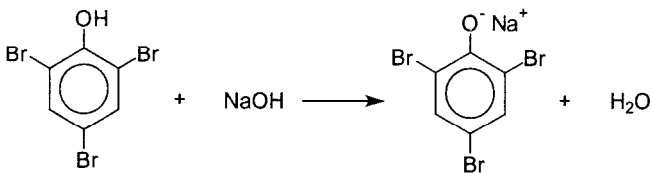
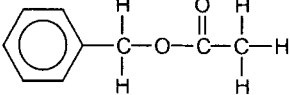
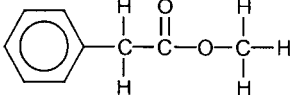
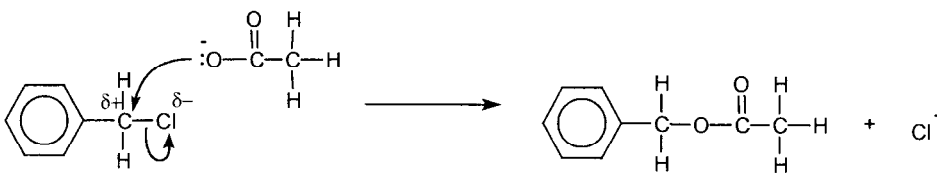


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Qu.	Expected answers:	Marks
1 (a)	propanone ✓ $  \begin{array}{c}  \text{H} \quad \text{O} \quad \text{H} \\    \quad    \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $ ✓	[2]
(b) (i)	propan-2-ol ✓ $  \begin{array}{c}  \text{H} \quad \text{OH} \quad \text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $ ✓	[2]
(ii)	NaBH <sub>4</sub> ✓	[1]
(iii)	C <sub>3</sub> H <sub>6</sub> O + 2[H] → C <sub>3</sub> H <sub>8</sub> O / C <sub>3</sub> H <sub>7</sub> OH ✓	[1]
(c)	2,4-dinitrophenylhydrazine ✓ yellow / orange/red ... crystals /solid / ppt. etc ✓ (re)crystallise / purify ✓ measure melting point/m.p. (of product) ✓ compare with known compounds ✓	
	<b>ANY 4 out of 5</b>	max [4]
		<b>[Total: 10]</b>

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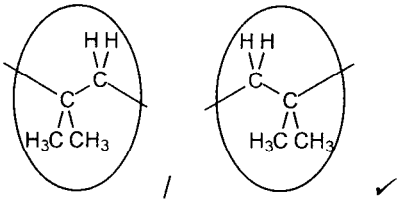
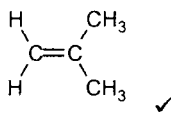
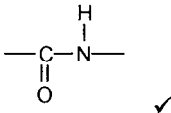
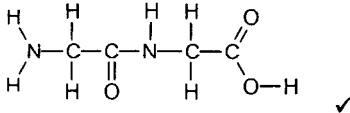
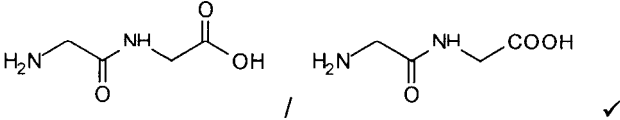
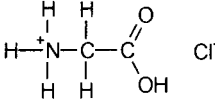
Qu.	Expected answers:	Marks
2 (a) (i)	$\text{C}_6\text{H}_6 + \text{Br}_2 \longrightarrow \text{C}_6\text{H}_5\text{Br} + \text{HBr}$ organic product ✓ rest of the equation also correct ✓	[2]
(ii)	$\text{FeBr}_3$ / $\text{AlBr}_3$ / iron(III)bromide / aluminium bromide	[1]
(b) (i)	 ✓✓	[2]
(ii)	 organic product ✓ (allow ecf from (i) but must be a ring with OH) rest of the equation <u>also</u> correct ✓	[2]
(iii)	(benzene) ring is <u>activated</u> ✓ lone pair on oxygen is delocalised / interacts with the $\pi$ electrons ✓ more ( $\pi$ ) electron density (around ring) ✓ attracts bromine / electrophiles more / polarises $\text{Br}_2$ molecule more ✓	ANY 3 marks from 4 max [3]
(iv)	antiseptics / disinfectants	[1]
		[Total: 11]

Qu.	Expected answers:	Marks
3 (a) (i)	NaOH / KOH / OH <sup>-</sup> / H <sub>2</sub> O ✓	[1]
(ii)	nucleophilic ✓ substitution ✓	[2]
(iii)	$\text{C}_6\text{H}_5\text{CH}_2\text{Cl} + \text{NaOH} \longrightarrow \text{C}_6\text{H}_5\text{CH}_2\text{OH} + \text{NaCl}$ $\quad \quad \quad / \text{OH}^- \longrightarrow \text{Cl}^-$ if water in (i), then: $\text{H}_2\text{O} \longrightarrow \text{HCl}$	[1]
(b) (i)	allow either  or  ✓	[1]
(ii)	$\text{C}_6\text{H}_5\text{CH}_2\text{OH} + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COOCH}_2\text{C}_6\text{H}_5 + \text{H}_2\text{O} \quad \checkmark$ allow C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> COOCH <sub>3</sub> as the ester	[1]
(iii)	perfumes / flavourings / solvents ✓	[1]
(iv)	suggested mechanisms could be S <sub>N</sub> 1 or S <sub>N</sub> 2 type (such as the example shown below)	
		
	look for diagram or words describing: nucleophilic ✓ substitution / ester + Cl <sup>-</sup> as products ✓ dipole on C-Cl bond ✓ curly arrow from COO <sup>-</sup> to C ✓ curly arrow from bond to Cl ✓	
	<b>ANY 3 out of 5</b>	max [3]
	(allow anything reasonable producing C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> COOCH <sub>3</sub> )	
		<b>[Total: 10]</b>

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Qu.	Expected answers:	Marks
4	<p>(at a temperature) <math>&lt; 10^{\circ}</math> ✓ <b>ESSENTIAL</b> mark</p> <p>(reagent is) nitrous acid / <math>\text{HNO}_2</math> ✓  (made by) sodium nitrite / <math>\text{NaNO}_2</math> ... ✓  ... (with) hydrochloric acid / <math>\text{HCl}</math> ✓  ... (to give diazonium salt with formula) eg <math>\text{C}_6\text{H}_5\text{N}_2^{+}</math> / <math>\text{C}_6\text{H}_5\text{N}_2\text{Cl}</math> / <math>\text{C}_6\text{H}_5\text{N}^{+}\equiv\text{N Cl}</math> ✓</p> <p>balanced equation - e.g. <math>\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2 + \text{H}^{+} \longrightarrow \text{C}_6\text{H}_5\text{N}_2^{+} + 2\text{H}_2\text{O}</math> ✓  (any of the other marks above may be awarded if they appear in an equation)</p> <p><b>MAX</b> 4 from these 5</p> <p>(used to form) dyes / colourings / coloured compounds ✓ <b>ESSENTIAL</b> mark</p>	<p>[1]</p> <p>max [4]</p> <p>[1]</p> <p>[Total: 6]</p>

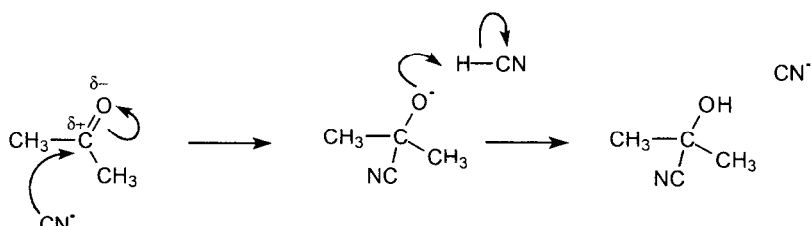
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Qu.	Expected answers:	Marks
5 (a) (i)		[1]
(ii)	CH <sub>2</sub> ✓	[1]
(iii)		[1]
(b) (i)	peptide / amide ✓	[1]
		[1]
(ii)	condensation ✓	[1]
(iii)		[1]
		[1]
5 (b) (iv)	<p>M<sub>r</sub> glycine, C<sub>2</sub>H<sub>5</sub>NO<sub>2</sub> = <b>75.(0)</b> ✓</p> <p>M<sub>r</sub> C<sub>4</sub>H<sub>8</sub>N<sub>2</sub>O<sub>3</sub> = <b>132.(0)</b> ✓</p>	[2]
	<p>use of 2:1 ratio to give <b>0.009333</b> mol of dipeptide <b>H</b> expected / ecf ✓</p> <p>(or use of 2:1 ratio to give mass ratio of <b>150:132</b> / ecf)</p>	[1]
	<p>answer in the range <b>89.2 - 89.4</b> with 3 sf / ecf ✓ (correct answer gets all <b>4</b> marks)</p> <p>(answer in the range <b>44.6 - 44.7</b> (no 2.1) with 3 sf gets <b>3</b> marks overall)</p>	[1]
(v)	 <p>H<sub>3</sub>N<sup>+</sup>CH<sub>2</sub>COOH Cl<sup>-</sup> /</p> <p>NH<sub>3</sub><sup>+</sup> group ✓</p> <p>rest of the molecule and Cl<sup>-</sup> ✓</p>	[2]
		[Total: 14]

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Qu.	Expected answers:	Marks
6 (a) (i)	$C_7H_8O$ ✓	[1]
(ii)	$M_r = 108$ so $m/e$ of molecular ion = <b>108</b> / ecf from (i) ✓	[1]
(iii)	$\%C = (84.0)/(108) \times 100\% = \mathbf{77.8\%}$ ✓ $\%H = (8.0)/(108) \times 100\% = \mathbf{7.4\%}$ ✓ / ecf from (i) or (ii)	[2]
(b)	<b>K</b> has OH group ✓ <b>K</b> has peak at $3230 - 3550\text{ cm}^{-1}$ ✓ <b>L</b> does not have OH group / peak at $3230 - 3550\text{ cm}^{-1}$ ✓ (ignore reference to any other bonds)	[3]
(c) (i)	peak at $\delta = 7.3\text{ppm}$ / with area 5, is due to the benzene ring (protons) ✓ peak at $\delta = 4.5\text{ppm}$ / with area 2, is due to the $-CH_2-$ (protons) ✓ peak at $\delta = 3.2\text{ppm}$ / with area 1, is due to the OH (proton) ✓	[3]
(ii)	peak at $\delta = 3.2\text{ppm}$ / with area 1 disappears / ecf from (i) ✓	[1]
(iii)	expect peak at $\delta = 7.1-7.7\text{ ppm}$ ✓ 5 protons responsible / area = 5 ✓ expect peak at $\delta = 3.3-4.3\text{ppm}$ ✓ 3 protons responsible / area = 3 ✓	[4]
		<b>[Total: 15]</b>

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Qu.	Expected answers:	Marks
7 (a)	CH <sub>3</sub> CH <sub>2</sub> COOH ✓	[1]
(b)	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub> ✓	[1]
(c)	CH <sub>3</sub> Cl / CH <sub>3</sub> Br ✓ AlCl <sub>3</sub> / FeCl <sub>3</sub> / FeBr <sub>3</sub> etc ✓	[2]
(d)	C <sub>6</sub> H <sub>5</sub> NH <sub>3</sub> <sup>+</sup> / C <sub>6</sub> H <sub>5</sub> NH <sub>2</sub> ✓	[1]
(e)	CH <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub> ✓	[1]
(f) (i)	(CH <sub>3</sub> ) <sub>2</sub> C(OH)CN etc ✓	[1]
(ii)	nucleophilic addition ✓	
 <p>Look for the following in a diagram as above or description: (dipoles <b>not</b> required)</p> <p>CN<sup>-</sup>/nucleophile attacks (δ)<sup>+</sup> carbonyl C / curly arrow from CN<sup>-</sup> to carbonyl C ✓          (curly arrow) breaking C=O ✓          correct structure of the intermediate ✓          curly arrow from O<sup>-</sup> to HCN / H<sub>2</sub>O ✓</p> <p><b>ANY 5</b> out of the <b>6</b> marks above</p> <p>(curly arrows must be clearly from and to the correct bond / atom to gain the mark)</p>		
		<b>max</b> [5]
		<b>[Total: 12]</b>

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<b>Qu.</b>	<b>Expected answers:</b>	<b>Marks</b>
<b>8</b>	<p>(<b>structural</b> isomerism is) same molecular formula, different structural formulae ✓</p> <p>two correct structures of suitable example ✓</p> <p><b>stereoisomerism</b> (is same structural) formula /order of bonds, different spatial arrangements of the atoms ✓</p> <p>(<b>cis-trans</b> / <b>geometric</b> isomerism is due to) non-rotation around a C=C double bond ✓</p> <p>two correct structures of suitable example ✓</p> <p>(<b>optical</b> isomerism is when) molecules are non-superimposable mirror images / asymmetric / contain a chiral centre ✓</p> <p>(or polymers may be isotactic, atactic or syndiotactic)</p> <p>carbon atom is attached to four distinguishable / different groups / atoms /(or shown in diagram) ✓</p> <p>(or polymer side chain on the same, random or alternate sides)</p> <p>two correct 3-d structures of suitable example ✓</p> <p><b>8 points on isomerism (3 MAX for optical isomerism / polymers)</b></p> <p>(synthesis of only one stereoisomer of a <b>pharmaceutical</b> is good because . . .)</p> <p>... only one of the two stereoisomers may be active /the two isomers may have different activity in the body ✓</p> <p>... a smaller dose needed /saves cost of materials/separation ✓ (ora)</p> <p>... the other may have (harmful) side effects ✓</p> <p>good example of stereospecific drug e.g Thalidomide / Dopa / Ibuprofen ✓</p> <p><b>4 points on chiral synthesis</b></p> <p><b>Quality of Written Communication</b></p> <p>the answer is coherent, and at least <b>two</b> of the specialist terms: <b>structural</b>, <b>cis-trans/geometric</b> and <b>optical isomerism</b> are assigned correctly ✓</p> <p>the text contains at least two legible sentences with reasonably accurate spelling, punctuation and grammar ✓</p>	<p><b>max</b> <b>[10]</b></p> <p><b>[2]</b></p> <p><b>[Total: 12]</b></p>